

CLAIMS

What is claimed is:

- 1 1. A liquid catalyst mixture receptacle comprising:
2 a receptacle body having a first wall with a vertical portion and an angled portion;
3 an air inlet to the receptacle body through the first wall, the air inlet being spaced
4 from the vertical portion of the first wall by the angled portion such that if
5 air bubbles are released into a catalyst mixture in the receptacle body from
6 the air inlet, the air bubbles do not contact the vertical wall portion of the
7 first wall before reaching an upper surface of the catalyst mixture; and
8 an opening in a wall of the receptacle body for releasing sparging gas from the
9 body.
- 1 2. The liquid catalyst mixture receptacle of claim 1, wherein the air inlet opening is
2 horizontally spaced from the vertical portion of the first wall by a distance of
3 approximately 1/4 inch or greater.
- 1 3. The liquid catalyst mixture receptacle of claim 2, wherein the air inlet opening is
2 horizontally spaced from the vertical portion of the first wall by a distance of
3 approximately 5/8 inch or greater.

1 4. The liquid catalyst mixture receptacle of claim 1, further comprising a chamber in
2 communication with the opening in the wall, the chamber having a plurality of
3 cross-sectional plane areas parallel to the opening, the opening in the wall having
4 an area smaller than a largest area of the cross-sectional plane areas.

1 5. The liquid catalyst mixture receptacle of claim 1, wherein the wall opening has a
2 dimension of approximately 1/4 inch or greater.

1 6. The liquid catalyst mixture receptacle of claim 5, wherein the wall opening has a
2 dimension of approximately 5/8 inch or greater and a dimension of the largest of
3 the cross-sectional plane areas is approximately 1.5 inch or greater.

1 7. The liquid catalyst mixture receptacle of claim 1, further comprising a check
2 valve in fluid communication with the air inlet.

1 8. The liquid catalyst mixture receptacle of claim 7, wherein the check valve
2 comprises a buoyant stopper sized and shaped to block the air inlet if liquid rises
3 above a stop level in the air inlet to permit air to flow around the stopper if liquid
4 does rise above the stop level in the air inlet.

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1 9. The liquid catalyst mixture receptacle of claim 8, wherein the check valve further
2 comprises a sealing gasket disposed about the air inlet such that the buoyant
3 stopper contacts and creates a sealing engagement with the sealing gasket to block
4 the air inlet if liquid rises above the stop level in the air inlet.

1 10. The liquid catalyst mixture receptacle of claim 1, wherein the body of the
2 receptacle includes a reinforcing indentation in a wall thereof, the reinforcing
3 indentation being oriented and positioned such that the receptacle body may be
4 strapped to a vehicle by aligning and seating a strap upon the reinforcing
5 indentation.

1 11. A liquid catalyst mixture receptacle comprising:
2 a receptacle body having an opening in a wall thereof;
3 an air inlet to the receptacle body; and
4 a chamber in communication with the opening in the wall, the chamber having a
5 cross-sectional area larger than an area of the opening.

1 12. The liquid catalyst mixture receptacle of claim 11, wherein a dimension of the
2 opening in the wall is approximately 1/4 inch or greater.

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- 1 13. The liquid catalyst mixture receptacle of claim 12, wherein a dimension of the
2 opening in the wall is approximately 5/8 inch or greater.
- 1 14. The liquid catalyst mixture receptacle of claim 11, further comprising a check
2 valve in fluid communication with the air inlet.
- 1 15. The liquid catalyst mixture receptacle of claim 14, wherein the check valve
2 comprises a buoyant stopper sized and shaped so as to block the air inlet if liquid
3 rises above a stop level in the air inlet to permit air to flow around the stopper if
4 liquid does not rise above the stop level.
- 1 16. A liquid catalyst delivery system comprising:
2 a liquid catalyst receptacle having an air inlet and an outlet; and
3 a catalyst transport for transporting catalyst particles in a sparging gas to a flame
4 zone of a combustion process, the catalyst transport comprising:
5 a first sparging gas transport path coupled to the receptacle outlet and
6 configured to transport sparging gas at a first rate; and
7 a second sparging gas transport path coupled to the receptacle outlet and
8 configured to transport sparging gas at a second rate in response to
9 an increase in demand for catalyst at the flame zone.

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- 1 17. The liquid catalyst delivery system of claim 16, wherein the first sparging gas
2 transport path comprises a pump coupled to the receptacle outlet, the pump
3 configured to pump the sparging gas from the receptacle outlet at the first rate.
- 1 18. The liquid catalyst delivery system of claim 17, wherein the second sparging gas
2 transport path comprises a check valve configured to open to sparging gas flow
3 therethrough in response to pressure on a side of the check valve exceeding a
4 predetermined threshold pressure.
- 1 19. The liquid catalyst delivery system of claim 16, wherein the first and second
2 transport paths join into a joined transport path configured to transport the
3 sparging gas from the first and second transport paths, and wherein the second
4 transport path is configured to transport catalyst only when vacuum pressure in
5 the joined transport path exceeds a predetermined threshold pressure.
- 1 20. The liquid catalyst delivery system of claim 16, wherein the first rate is a variable
2 rate.
- 1 21. The liquid catalyst delivery system of claim 16, wherein the second rate is a
2 variable rate.

1 22. The liquid catalyst delivery system of claim 16, further comprising a catalyst
2 transport control coupled to the catalyst transport and configured to regulate flow
3 of sparging gas through at least one of the transport paths.

1 23. The liquid catalyst delivery system of claim 16, further comprising a catalyst
2 transport control configured to monitor catalyst transport and relay catalyst
3 transport information to a remote location.

1 24. The liquid catalyst delivery system of claim 23, wherein the catalyst transport
2 information comprises an indication that a predetermined threshold of operation
3 has been reached.

1 25. The liquid catalyst delivery system of claim 16, further comprising a mounting
2 plate coupled to the receptacle and a vibration source.

1 26. The liquid catalyst delivery system of claim 25, wherein the vibration source
2 comprises a pump.

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1 27. The liquid catalyst delivery system of claim 16, wherein the receptacle comprises
2 an air inlet opening positioned and oriented such that air bubbles released into a
3 catalyst mixture in the receptacle from the air inlet opening do not contact a solid
4 object before reaching an upper surface of the catalyst mixture.

1 28. The liquid catalyst delivery system of claim 16, wherein the receptacle comprises
2 a chamber in communication with an opening in a wall of the receptacle, the
3 chamber having a cross-sectional area larger than an area of the opening.

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1 29. A method of providing catalyst to an air intake for a combustion process, the
2 method comprising:
3 sparging air through a liquid catalyst mixture in a receptacle to produce sparging
4 gas;
5 transporting the sparging gas from the receptacle at a first rate before transporting
6 the sparging gas from the receptacle at a second rate higher than the first
7 rate when demand for sparging gas at the air intake exceeds a
8 predetermined threshold.

1 30. The method of claim 29, wherein the second rate is a variable rate.

1 31. The method of claim 29, wherein the variable rate corresponds to a vacuum
2 pressure caused by air moving through the air intake.

1 32. The method of claim 29, wherein transporting sparging gas at a first rate
2 comprises pumping the sparging gas with a vacuum pump.

1 33. The method of claim 29, wherein transporting sparging gas at the first rate
2 comprises transporting sparging gas through a first transport path and transporting
3 sparging gas at the second rate comprises transporting sparging gas through both
4 the first transport path and a second transport path.

- 1 34. The method of claim 33, wherein transporting sparging gas at the second rate
2 comprises opening a valve to allow sparging gas to be drawn through the second
3 transport path by a vacuum caused by air moving through the air intake.

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1 35. A method of sparging air through a catalyst mixture to produce a sparging gas, the
2 method comprising
3 bubbling air through a catalyst mixture in a receptacle;
4 transferring catalyst particles to an air space above the catalyst mixture to produce
5 a sparging gas; and
6 transporting the sparging gas within the receptacle at a first velocity toward a
7 receptacle outlet, then transporting the sparging gas within the receptacle
8 at a second velocity less than the first velocity toward the receptacle outlet,
9 then transporting the sparging gas within the receptacle to the receptacle
10 outlet.

1 36. The method of claim 35, wherein transporting the sparging gas within the
2 receptacle at the first velocity, then a second velocity, then to the receptacle outlet
3 comprises passing the sparging gas through a chamber between a body of the
4 receptacle and the receptacle outlet, the chamber having an opening with an
5 opening area smaller than a maximum cross-sectional area of the chamber.

1 37. The method of claim 35, further comprising releasing bubbles into the catalyst
2 mixture from an inlet structure having a vertical portion and an angled portion, the
3 angled portion horizontally spacing the released bubbles from the vertical portion

1 such that the bubbles do not contact the vertical portion before they reach a
2 surface of the catalyst mixture.

1 38. The method of claim 37, wherein releasing the bubbles comprises releasing the
2 bubbles away from any vertical surface.

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